

**REMARKS**

By this amendment, claims 1-25, 34-38, and 51-70 are pending in the application, of which claim 11 is being amended. Claims 26-33 and 39-50 are being canceled without prejudice or disclaimer as drawn to a non-elected invention. Claims 55-70 are being added.

The claim amendments and added claims are fully supported by the original claims and Specification, and entry of the claim amendments is respectfully requested.

For example, claim 11 is being amended to correct a typographical error. This amendment is supported by the original Specification and claims as filed, and adds no new subject matter. For example, the "underlying material" language in amended claim 11 is supported in claim 1 as originally filed.

Claim 55 is equivalent to originally-filed dependent claim 24 as written in independent form. Therefore, claim 55 is not a further limitation on a claim but rather a re-phrasing of dependent claim 24.

Reconsideration of the present case in view of the remarks herein is respectfully requested.

**Rule 131 Declaration**

Applicant is herewith submitting a Declaration under 37 C.F.R. § 1.131 that shows an invention date of the present claims prior to September 25<sup>th</sup>, 2000, which is the effective date of U.S. Patent No. 6,283,131 to Chen et al. The Rule 131 Declaration sets forth facts that establish that Applicant conceived of the subject invention prior to September 25<sup>th</sup>, 2000, and that diligence was exercised from the time of conception of the invention, to September 25<sup>th</sup>, 2000, the filing date of the Chen et al. patent, and up to the time of filing of the present application on November 21, 2000.

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Therefore, Chen et al. is not Prior Art. If the Examiner has any questions regarding the Rule 131 Declaration, the Examiner is respectfully requested to call the undersigned.

**102(e) Rejection of Claims 1-4, 6-25, 34-38, and 51-54 and**

**103(a) Rejection of Claim 5**

The Examiner rejected claims 1-4, 6-25, 34-38, and 51-54 under 35 U.S.C. 102(e) as being unpatentable over U.S. Patent 6,283,131 to Chen et al. The Examiner also rejected claim 5 under 35 U.S.C. 103(a) as being unpatentable over Chen et al. as applied in the Section 102(e) Rejection. These rejections are respectfully traversed.

Chen et al. is not Prior Art under 35 U.S.C. 102(e) because the date of invention of the subject matter recited in the present claims is before the filing date of Chen et al., as shown in the Rule 131 Declaration enclosed herewith.

Thus, claims 1, 14, 34, and 51, and the claims dependent therefrom, including claims 2-13, 15-25, 35-38, and 52-54, are allowable over Chen et al. (not Prior Art)

**Section 112 Rejection of Claims 11 and 12**

The Examiner rejected claims 11 and 12 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The Examiner rejected claim 11 for lack of proper antecedent basis in the term "the layer." This claim is being amended to refer to "the underlying material" of claim 1. Thus, amended claim 11 and the claims dependent therefrom, including claim 12, are believed to be allowable over Section 112, Second Paragraph.

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**CONCLUSION**

The above-discussed amendments are believed to place the present application in condition for allowance. Should the Examiner have any questions regarding the above remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,

JANAH & ASSOCIATES  
A PROFESSIONAL CORPORATIONDate: May 5, 2003

By:

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Yuen et al.	Group Art Unit: 1763
Application No.: 09/718,319	Examiner: George A. Goudreau
Confirmation No.: 3056	Attorney Docket No.: 004704
Filing Date: November 21, 2000	USA/ETCH/SILICON/JB1
Title: ETCHING A SUBSTRATE IN A PROCESS ZONE	May 5, 2003 San Francisco, California

**DECLARATION PURSUANT TO 37 C.F.R. § 1.131**

Commissioner for Patents  
Washington, D.C. 20231

Via Facsimile Transmission  
(703) 872-9311

Examiner Goudreau:

I. This declaration is to establish completion of the invention of this application in the United States, at a date prior to September 25<sup>th</sup>, 2000, which is the effective date of the U.S. Patent No. 6,283,131 to Chen et al.

II. The person making this declaration is the inventor of the invention described in the present application.

III. Attached to this Declaration is Exhibit A, which shows my inventive activity prior to September 25<sup>th</sup>, 2000. The attached document has been reproduced with one or more whited-out sections. All of the attached documents were prepared prior to September 25<sup>th</sup>, 2000. The development described herein was conducted by the undersigned also prior to September 25<sup>th</sup>, 2000 at the Applied Materials facilities in Santa Clara, California.

IV. EXHIBIT A is a description of inventive matter that was written prior to September 25<sup>th</sup>, 2000.

V. In Paragraph 6 of EXHIBIT A, an "in-situ, mid-process removal of photoresist during a multi-layer etch recipe" is described.

VI. Paragraph 6 describes "initial film stacks consisting of photoresist and a hardmask layer." These "film stacks" are examples of the "substrate comprising etch resistant material over an underlying material" as recited in pending claim 1. It also an example of the "substrate comprising a first and a second etch resistant material" of claim 14 since photoresist and hardmask are both etch resistant materials. The photoresist on the substrate, as described in Paragraph 6, is also an example of a process residue on a surface of a process chamber that is obtained after etching of the mask layers covered by the photoresist, as recited in steps (b) and (c) of claim 34. The cited language is also an example of the "substrate comprising resist material over mask material" of claim 51.

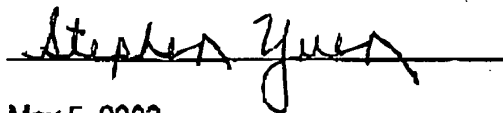
VII. Item (a.) describes that the "photoresist can now be removed in mid-process rather than at etch completion." This section provides an example of the following language recited in claim 1: "(b) removing the etch resistant material in the process zone; and after (b), providing an energized process gas in the process zone to etch the underlying material." Item (a.) also corresponds to steps (b) and (c) of claim 14. The recitation of step (d) as coming "after (c)" corresponds to the mid-process description of Item (a.). In addition, Item (a.), read in light of Paragraph 7, corresponds to steps (c) and (d) of claim 51, which recite remove a resist material and etching a layer under a mask material.

VIII. From the time of conception of the invention to September 25<sup>th</sup>, 2000, the date of filing of the Chen et al. patent, and up to the time of filing of the present application on November 21, 2000, I diligently worked on improving the invention, evaluating experimental results, and in the process for the preparation of the presently filed patent application.

IX. As the person signing below, I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Stephen Yuen

Signature:



Date:

May 5, 2003

Residence:

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**EXHIBIT A**

TO: Gaile Bailey M/S 204  
 Extension: 32724  
 Current Date:

**CIRCLE ONLY ONE APPLICABLE DIVISION AND PRODUCT BUSINESS GROUP(PBG)**  
 PLEASE SUBMIT ONE ORIGINAL, SIGNED DOCUMENT FOR RECORDING IF THIS IS A  
 COPY OF A PREVIOUSLY SUBMITTED ALERT, PLEASE MARK IT ACCORDINGLY

TPI	CVD	ETCH	CMP	ATD	IBSS	CORE	PRP	PVD	AKT	SOFTWARE
EPI	KPU1	METAL	CMP	ATD	IBSS	CORE TEC	PRP	PVD	ACVD	AML
HTF	KPU2	SILICON		CORP		PSI			APVD	AMI
RTP	KPU3	HDP				CORE ENG			ETCH	
AIT	KPU5	MP&RPS				PROCOMP			AHRDWR	
	KPU6	COM ENG				CORE KNO				
		HEXODE				MICRO				

Please use separate attachments for any answers that don't fit on the form, especially for questions 3-8. If the answer to a question is "NONE", please write "NONE" rather than leaving the answer blank.

1.

2. Inventors-Names only-(please print clearly and provide complete information at Section 9.)

STEPHEN YUEN

MOHIT JAIN

THORSTEN WILL

3.

5.

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6. Describe the invention, preferably with reference to attached drawings:

See attached

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7.

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8.



INVENTION ALERT FORM

6. The invention describes an in-situ, mid-process removal of photoresist during a multi-layer etch recipe. This in-situ photoresist removal process is incorporated into the etch process rather than as a separate etch or clean-up step. This would apply to initial film stacks consisting of photoresist and a hardmask layer (DARC, nitride, oxide,...). Photoresist is intentionally removed in its own separate etch step (after the hard mask is opened) without having to remove the wafer from the etch chamber for any type of "ex-situ" treatment.

7. As the industry migrates to thinner photoresist, adequate preservation of photoresist during the etch process becomes more critical and challenging. Accidental/unintentional depletion of photoresist midway through the etch process could severely impact profile and CD. Etching with hardmasks is a viable alternative. Hardmask etches allow for better CD control and better gate oxide selectivity. However, formation of the hardmask requires an additional etch process in a separate etch chamber. The photoresist must then be removed using standard post-etch treatments. An in-situ etch processes whereby both the hardmask and the intended film layer are etched will improve productivity by eliminating the extra "ex-situ" etch and clean-up steps. But an extra burden would now be placed on the etch process. The initial photoresist thickness must be sufficient to withstand the entire etch process. If at any time during the etch process the photoresist is unexpectedly depleted, the etch performance could then be compromised. The "In-situ Photoresist Removal Within a Multi-layer Etch Process" would allow greater flexibility in process tuning because now the initial photoresist thickness does not have to withstand the entire etch process but only until the hardmask is defined, which is a much smaller portion of the process. This now allows the etch process to behave as both a "soft mask" etch (before photoresist removal) and as a "hard mask" etch (after photoresist removal).

a. The in-situ photoresist strip process is incorporated into the etch process rather than as a separate etch or clean-up step. The photoresist can now be removed in mid-process rather than at etch completion (traditional method).

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Product Group: \_\_\_\_\_ Dept #: \_\_\_\_\_

**FOR ADDITIONAL INVENTORS, PLEASE COMPLETE AND ATTACH ADDITIONAL SHEET AS NEEDED.**

(d) Signature, date and **PRINTED** name of each inventor plus two witnesses who have read and understood this Invention Alert form:

**Inventors:**STEPHEN YUEN

Printed Name

Date

Stephen Yuen

Signature

MOHIT JAIN

Printed Name

Date

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THORSTEN LILL

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Signature

Printed Name

Date

Signature

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